Title: Photoconductivity, photoluminescence and charge collection in semiinsulating CdTe and CdZnTe

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Abstract:

Cadmium telluride and its compounds with zinc are the material of choice in spectroscopic room temperature high energy radiation detectors. The development of the final device is influenced by many parameters, including material impurities and defects, homogeneity and surface preparation. This thesis offers a comprehensive investigation of the detector fabrication process and of the parameters and physical effects influencing the spectroscopic resolution and performance of the detector. Structure of deep levels is investigated through photoluminescence and correlated with other electro–optical measurements dealing with the impact of structural imperfections of the material and their effect.

The influence of resistivity and photoconductivity homogeneity on the detector performance is studied through electrical measurement of the charge carrier transport and charge collection of the sample. Obtained results are explained using the Fermi level shift theory and confronted with a theoretical model and calculations.

The impact of surface treatments and oxidation of the surface on resistivity, photoconductivity and the general performance of CdTe and CdZnTe samples is investigated. Changes in the attributes of the detector over time are observed. Correlation of studied surface TeO_2 oxide layer growth with decreased leakage current over time after surface etching is made.

Keywords:
CdTe, Deep levels, Space charge, Surface preparation.